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Page.

EDITORIAL ... 313

ORIGINAL ARTICLES.

THE SOLID AND LIQUID COMPONENTS OF PALM OIL.
By T. A. Buckley, M.Sc., Ph.D., F.I.C. ... 315

MANURIAL EXPERIMENTS ON OIL PALMS.
By W. N. C. Belgrave, B.A., Cam. Dip. Agr. and Staff of Agricultural Division ... 321

ABSTRACTS.

ANNUAL REPORT ON THE DRAINAGE AND IRRIGATION DEPARTMENT OF THE FEDERATED MALAY STATES FOR THE YEAR 1934 ... 336

TWENTY-SECOND REPORT ON NATIVE RUBBER IN THE NETHERLANDS INDIES ... 341

DEPARTMENTAL.

FROM THE DISTRICTS ... 345

DEPARTMENTAL NOTES ... 348

KELANTAN AGRICULTURAL SHOW ... 349

STATISTICAL.

MARKET PRICES JUNE 1935 ... 350

GENERAL RICE SUMMARY MAY 1935 ... 354

MALAYAN AGRICULTURAL EXPORTS, MAY 1935 ... 356

MALAYAN PRODUCTION OF PALM OIL AND KERNELS... ... 356

AREA OUT OF TAPPING MAY 1935 ... 357

MALAYAN RUBBER STATISTICS, MAY 1935 ... 358

METEOROLOGICAL SUMMARY, MAY, 1935 ... 359

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JULY, 1935.

EDITORIAL.

Industrial Uses of Palm Oil.

It is an undoubted fact that plantation palm oil has not found that ready acceptance in the market for edible purposes to which it is entitled on account of its purity.

This attitude of the market has made it all the more imperative that new uses should be found for which the plantation product is especially suited, and the investigation of the potentialities of palm oil along these lines is more likely to be fruitful of results than persistence in the claims of this product to markets in which other oils already hold a strong position.

If our appreciation of the position is correct, the recent work of Dr. Buckley may prove of considerable value to the plantation oil industry. A preliminary account of his researches concerning the liquid and solid fractions of palm oil is published in this number. It is well-known that palm oil at normal temperatures consists of two components, a solid and a liquid, which hitherto have been marketed together. Dr. Buckley now suggests that these two components should be isolated and marketed separately, and he shews with what ease this separation may be effected in the country of production. He isolates the liquid fraction known as palm oleine, partly in settling tanks and partly by subjecting the orange-coloured paste which settles in the tanks to pressure in a filter-press. By repeated press treatment of the paste, further quantities of palm oleine are separated leaving a pale yellow solid fraction, known as palm stearine, which is brittle and falls into fragments and powder on handling and is only slightly greasy to the touch.

A point of some importance in this isolation process is that in Malaya the temperature normally prevailing is suitable without artificial control.

We would emphasize the fact that although this separation of palm oleine and palm stearine has been shewn to be commercially possible, it is not yet certain that these products would find a market in this form. The author considers that palm stearine would be less suitable for edible purposes owing to its high melting point, while he considers that palm oleine may be recommended for direct use as an edible oil.

The fact of importance at the moment is that palm oil may be marketed as two definite products; it remains, however, to be proved whether this discovery will open up an extended market for plantation palm oil.

Manuring of Oil Palms.

Records of experiments on the manuring of oil palms have been presented, from time to time, in this Journal. In the present number, these are brought up to date by the inclusion of figures for the year 1934.

It will be seen that the experiments have been carried on for some years and figures of yields of fruit of trees subjected to various manurial treatment are stated, in most cases, in respect of six years. The investigation has therefore reached a stage where considerable reliance may be placed on the results. The results are further strengthened by their general agreement with an independent experiment of a similar nature, details of which are given in an appendix.

The conclusions stated by the authors are of a practical nature. It is not sufficient to shew that the application of a fertilizer gives a significant increase of crop, for the practical planter desires to know whether the increase in crop will more than pay for the fertilizers and costs incidental to their application. Considered from this point of view, the authors are of opinion that where abnormally low yields are the result of unsuitable soil conditions, manuring may be a waste of money. They further shew that on the normal soils of the inland type, the application of nitrogen and potash manures appears unnecessary, but that phosphatic manures, supplied as rock phosphate, may be remunerative. On such soils manuring proved profitable when the yield of oil from eight year old palms was less than 1,500 lbs. per acre.

It should always be remembered that the general application of the results of manurial experiments without a preliminary trial, is open to risk, for local conditions may introduce factors widely different from those of the original experiment. But with such a crop as oil palms, a considerable time must elapse before the results are known, and during this time money may be lost through neglect of manuring. In these circumstances, the necessity of expert advice is of great importance and it is, therefore, strongly recommended that no considerable programme of manuring of oil palms should be adopted without consultation with those whose experience of such problems and the opportunities they have had of observing the varying conditions on different estates entitle them to express an opinion of value on the subject.

Original Articles.

THE SOLID AND LIQUID COMPONENTS OF PALM OIL

BY

T. A. BUCKLEY,

Assistant Chemist.

Palm oil when hot, as produced in the factory, is a clear red liquid, which on subsequent cooling deposits a solid; for this reason arrangements have always to be made for the heating of storage tanks so that it can be liquefied when desired.

When the oil is cooled quickly it forms an orange-coloured paste, because the solid separates in a very fine state of division. When it is cooled very slowly, naturally, as in a large tank, or with heat insulation in a small vessel, the solid separates in a coarsely granular form and sinks, so that there is an upper layer of clear red oil. Samples of palm oil are commonly seen with apparently very different proportions of solid and liquid, but as far as is known at present, the difference is almost entirely due to conditions of separation of the solid.

As the solid has a different composition from the liquid, exporters take care to liquefy and mix their oil before despatch and sampling, so as to avoid variations in composition. There is an alternative, however; that is to isolate the solid and liquid portions and market them separately. This alternative has been experimentally explored with results which will be described.

Commercial Treatment of Semi-solid Oils.

It has long been a practice in Europe and America to separate the solid and liquid portions of coconut, cottonseed and olive oils. In the case of the latter two to be used as salad oils, the object is to produce what is called a "winter oil" which is liquid in very cold weather. The solid component of coconut oil is desired as an ingredient of margarine and confectionery. The procedure is to chill or warm the oil as the case may be, and maintain it at a determined temperature while equilibrium is attained; then to filter-press it in a room at the same temperature. In the case of coconut oil the semi-solid mass is pressed in bags to express the liquid oil. The proportion of solid and liquid, stearine and oleine as they are termed, varies with the origin of the oil but mainly with the temperature at which separation is effected.

Application of Palm Oil.

There is no doubt that palm oil could be pressed in England, where it usually has the consistency of butter, though there is no information as to its being done. In Malaya it happens that the temperature normally prevailing

is suitable for the isolation of the two fractions, for the average day temperature in a building is about 84°F. all the year round, and no artificial control is required. There is no visible alteration in the proportion over a small range of temperature in the neighbourhood of 84°F., though large scale working in a building at 90°F. say would probably give a distinctly lower yield of solid than in another at 80°F.

Before proceeding to discuss methods of working, some of the objects of separating the solid and liquid component may be stated. Palm oil is suitable as an edible oil if the taste for it is acquired, and has special dietetic value on account of the carotene to which its colour is partly due, carotene serving as a source of vitamin A to the body. The carotene is not ordinarily destroyed by cooking, but the oil is objectionable on account of the partial solidification on the food which occurs on cooling [1]. This objection is simply overcome by use of the filtered red oil. For medicinal purposes, palm oil is more or less equivalent to cod-liver oil, and the liquid oil is obviously much easier to take than the ordinary semi-solid, but it is not imagined that the quantity likely to be employed for this purpose will affect the palm oil industry appreciably. The liquid oil (palm oleine) might be bleached and refined, at the sacrifice of its value as a source of vitamin, and used as a substitute for groundnut or other oils.

Palm stearine, the solid fat, is suitable as material for soap-making and as a source of fatty acid for candles. Solid fats usually command a higher price than liquid oils, and as such, are not common in Malaya. There is a further consideration that new uses often follow the production of a new material.

Methods of Separation of Palm Stearine and Palm Oleine.

It has been pointed out that the ordinary cold oil if filtered through canvas yields roughly equal proportions of a clear red liquid and an orange-coloured paste, and differences in the properties of the two have been recorded.[2] This process is of no utility because it is extremely slow and does not really isolate the solid.

Palm oleine can be readily produced in large quantities merely by allowing estate oil to cool in a large tank and stand for some days until deposition of solid is complete. Then the upper layer of liquid can be drawn off and freed from stray particles of solid by straining through muslin. If no attempt is made at complete isolation of the residual solid, the mass can be liquefied by heat and removed.

The first attempt at isolating palm stearine was made by filtering through paper in the laboratory by means of suction applied to a porcelain filter. A bottle of oil cooled in a hay box was used, and it was found that the liquid ran through with great ease, leaving the solid like a mass of crumbs. Application of pressure consolidated this to a stiff paste, which was re-melted, slowly cooled, and filtered again with a high vacuum in the filter vessel. A

further quantity of liquid was removed, after which the operation was repeated. Eventually when no more liquid separated, the solid, which formed 15 per cent. of the whole oil, was fairly hard and dry. Analyses were made of the two fractions obtained at this stage.

The next problem was the isolation of the stearine on a larger scale, for which purpose a filter-press seemed to be the most suitable equipment. Eventually an experimental filter-press was obtained, capable of treating some 12 gallons of oil. The oil from the Serdang factory was pumped into the press by a simple ball-valve pump from kerosene tins in which it had been slowly cooled. At first, the liquid ran through very freely and completely clear, but the flow slackened as the pressure increased owing to the building up of cakes of solid. Pumping was maintained at a pressure up to 120 lbs. per sq. inch until the flow of oil emerging was reduced to a drip. On opening the press, the solid was removed in firm yellow cakes, the liquid all having been collected clear and bright.

The filter-press cake, which has a melting point near 50°C. (122°F.) might be regarded as a finished commercial product, but it was desired to carry the investigation further. This material was next pressed in a screw press, which consists of a perforated steel cylinder standing on a tray on a base plate, into which a plunger is caused to descend by a screw. The fat was enclosed in cloth in the cylinder and very gradually submitted to pressure. Success depends on applying pressure very slowly, allowing time after each small increment for the liquid to ooze out, for the effect of over-hasty working is to cause a pasty mass to be extruded. In this way the filter-pressed fat yielded some 25 per cent. of liquid oil, and cakes of solid which were hard and rather brittle.

The solid had now a light yellow colour and was subjected to chemical examination and experiment; nevertheless it appeared that pressing had not yet reached finality. Some of it therefore was wrapped in cloth and submitted to hydraulic pressure, yet despite its apparent hardness it was squeezed out like butter, having no lateral support. Next, instead of attempting to apply greater pressure, the fat was re-melted and slowly cooled to induce coarse granulation. Renewed pressing in the screw press then expelled a considerable quantity of liquid, giving a still harder cake. Once again, the cake was re-melted, cooled, and pressed for the third time, whereon only a small further quantity of oil was expelled. The resulting cake, which was the final product of pressing in the present experiments, was so brittle that it fell into fragments and powder on handling and was only very slightly greasy to the touch. It still retained a pale yellow colour and formed a yellow liquid when molten.

Examination of Palm Stearine at Different Stages of Pressing.

It has already been shown that with continued pressing and expulsion of liquid oil, the solid becomes more and more powdery and paler in colour.

The progress of isolation of the solid was controlled by physical and chemical tests.

For comparison, some of the constants of whole palm oil may be given.

Temperature of total liquefaction	...	40—45°C.
Iodine value	...	50.3—52.7
Mean molecular weight	...	846

Filter-Press Cake.

The cake was yellow and rigid, but became bleached on the exterior when exposed to light. Though tending to crumble, it yielded to pressure of the thumb. The iodine value was 30.1 and the titre value* 50°C.

Fat Once Pressed in Screw Press.

The cake was lighter in colour and would not yield to thumb pressure. It was easily broken into fragments. When melted, it was a liquid of brownish yellow colour which on solidifying developed a remarkably furrowed surface. It bleached very rapidly in the light producing a pure white fat. Unfortunately, exposure to the light caused development of rancidity, with a pungent odour.

The free fatty acid content of the fat was almost exactly half of that of the liquid oil from which it was separated.

The fat was not difficult to saponify even by the "cold process". The soap was white in colour but so sparingly soluble in cold water that it would not lather. Saponified in conjunction with coconut oil, however, it gave a white soap of very satisfactory quality.

The fatty acid produced by adding mineral acid to the hot soap solution became practically white after separation. It had a crystalline structure and was quite hard, but oleic acid could be pressed out of it. The pressed fatty acid was still harder, and when incorporated with paraffin wax would be suitable for candles. Almost pure palmitic acid could be produced from it by crystallisation from alcohol.

The constants of the fat were as follows:—

Titre value	...	53.2°C.
Iodine value	...	20.9
Mean molecular weight	...	846

Fat Twice Pressed in Screw Press

The cake was again harder and paler. It was tested only for iodine value which was 15.0.

Fat Thrice Pressed in Screw Press.

The cake was markedly powdery and retained very little colour. Its characteristics were as follows:

---

*Titre value may be considered as melting point roughly. It is the maximum of the rise in temperature which occurs when a molten fat has nearly solidified.

Titre value	...	54.9°C.
Iodine value	...	11.7
Mean molecular weight	...	821.4

These successive sets of figures indicate a nearer approach to palmitin as the palm stearine is more nearly freed from liquid oil. The characteristics of palmitin may be given for comparison :

Melting point	...	61.5°C.
Iodine value	...	0
Mean molecular weight	...	807

Actually, chemical examination, which need not be here described, revealed that this final palm stearine contained approximately 80 per cent. of saturated glycerides (glycerides of palmitic acid mostly, together with myristic and stearic acids). The remainder was mostly liquid oil of the same composition as palm oleine, showing that pressing had not been adequate to expel all the liquid oil.

Hilditch and Jones,[3] found that Malayan palm oil contained approximately 9.1 per cent. of fully saturated glycerides.

Examination of Palm Oleine.

The palm oleine which was obtained simply by filtration of ordinary palm oil was a clear red liquid, which solidified to a butter-like mass in a refrigerator. It was permanently liquid at the ordinary temperature unless filtered too soon after cooling, in which case a further trace of solid separated after a time. Its free fatty acid content was a little higher than that of the original whole oil.

The characteristics of palm oleine were as follows :—

Iodine value	...	61.3
Mean molecular weight	...	856

Chemical examination showed that the oil was composed of glycerides of 64 per cent. liquid and 36 per cent. solid fatty acids.

Experiments in bleaching and refining were made, in which palm oleine was found easier to treat than the crude oil.

It was observed that ultra-violet light had no greater bleaching effect than ordinary sunlight.

Conclusions.

It has been shown that the solid and liquid components of palm oil may be easily separated at the prevailing temperature in Malaya. Isolation of the liquid alone can be effected with the greatest ease, but in isolating the solid the difficulty is dependent on the degree of hardness required.

It would be possible to extract partially either component from the complete oil and export the remainder, but such a procedure would be detected by altered constants and would not therefore be acceptable to users at home. There is no reason, however, why the standard palm stearine and palm oleine should not become articles of commerce.

The present work refers solely to plantation palm oils of acidity under 5 per cent., and not to oils of high acidity which are much harder or more solid both in Europe and in Malaya. On separation of the components, the free fatty acid tends to become concentrated in the oleine. From an original oil containing 4.2 per cent. of free fatty acid, there was obtained a solid cake of stearine (screw-pressed) of 2.0 per cent. acidity. The final cake, obtained by re-melting and pressing twice again, contained only 0.8 per cent. of free fatty acid. In the case of acid "hard" palm oils, it seems evident that there must be some degree of free acidity above which the solid acids separate from solution and increase the hardness of the mass.

The stearine contains less and less colouring matter the harder it is pressed, whence it is concluded that the oleine is correspondingly richer in carotene. The amount of colour remaining in palm stearine is so small that for soap-making purposes there is no necessity for bleaching.

Palm stearine might be marketed simply in the form of filter-press cake, but would be better if pressed harder. In any case it is hardly suitable as an edible fat, because its melting point is so much above body temperature. Its best use would apparently be for soap and candle manufacture. The yield from ordinary palm oil is from 20 per cent. of filter-press cake down to 10 per cent. of hard stearine.

Palm oleine may be recommended for direct use as an edible oil, but refinement with consequent loss of vitamin content may be necessitated if it is to compete with other oils.

References.

(1) Report of a Committee to Investigate and Report on the Vegetable Oil Producing Industries in Malaya, 1934. p. 62, para 299.

(2) The Oil Palm in Malaya, Bunting, Georgi and Milsum. Department of Agriculture, S.S. and F.M.S. p. 231, p. 223.

(3) Journal of the Society of Chemical Industry 1930. p. 363T.

MANURIAL EXPERIMENTS ON OIL PALMS

BY
W. N. C. BELGRAVE,
Chief Research Officer
and the
Staff of the Agricultural Division.

Accounts have been published in previous numbers of this Journal and in "The Oil Palm in Malaya"* of the lay-out, treatments and yield records of manurial experiments on oil palms in bearing conducted at the Central Experiment Station, Serdang, (Block 21) and on two estates. The present article brings these records up to date and gives an account of a later and larger experiment at Serdang (Block 5) and of an experiment on young palms on an estate. Analyses of certain of these soils are given in Appendix B.

The writers are indebted to Messrs. Imperial Chemical Industries (Malaya) Ltd. for permission to publish as an appendix an abstract of a report by Mr. E. R. Guest, their Senior Agricultural Adviser, on a manurial experiment on an estate in Selangor.

The general idea of the older experiments was the application of the following fertilizers to 10-tree plots.

Sulphate of ammonia (20 per cent. N) 1 lb. per palm half-yearly "N"
Superphosphate (18-20 per cent. P_2O_5) or basic slag (16 per cent. P_2O_5) 3 lbs. per palm half-yearly "P"
Sulphate of potash (48 per cent. K_2O) 1 lb. per palm half-yearly "K"
Sulphate of magnesia (16 per cent. MgO) 1½ lbs. per palm half-yearly "Mg"

These substances were applied alone or in combination to give mixtures designated below as NPK, PK, PK Mg etc. Applications were made twice yearly from July 1930 to July 1932 in the case of the estates and until February 1933 at Serdang; basic slag was everywhere substituted for superphosphate in 1932.

Owing to the presence of supplies on certain of the plots on the estates, results are expressed in pounds of fruit bunch per mature palm. All palms under experiment at Serdang were mature.

Estate A.

The experiment on this estate was fortunate in that accidents were few. There were six replications of each main treatment arranged in two blocks. Results are given in Table I.

It will be noted that there was no constant certain effect from the addition of magnesia to the manurial mixtures, and for statistical analysis this addition has been neglected.

* By Bunting, Georgi and Milsum, Kuala Lumpur, 1934.

Table I.

Yields in Pounds of Fruit Bunch per Mature Palm, planted 1922, on Quartzite Hill Soil. Estate A.

Palms planted 1922.

	No. of Mature Trees.	1929	1930	1931	1932	1933	1934
NPK	36	100	144	221	254	262	197
		} 101	} 148	} 234	} 259	} 286	} 198
NPK + Mg	17	102	157	259	268	334	199
PK	40	77	127	199	243	234	166
		} 77	} 118	} 199	} 240	} 247	} 187
PK + Mg	19	76	100	200	232	273	230
P	37	82	153	243	256	260	214
		} 86	} 148	} 240	} 246	} 251	} 209
P + Mg	17	93	128	234	220	232	200
Control	53	*90*	*177*	*167*	*181*	*185*	*141*
Mean		88.5	147.8	210.0	231.3	242.2	184.0

Table II shows yields expressed as percentages of the annual general means for convenience of comparison from year to year, and the results of statistical analysis.

Table II.

Yields expressed as Percentages of General Means. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	113.9	100.4	111.4	111.9	118.2	107.5
PK	86.3	79.5	95.0	103.7	102.1	101.6
P	97.5	100.1	114.4	106.3	103.7	113.9
Control	*102.2*	*120.0*	*79.2*	*78.4*	*76.4*	*76.9*
S.D.*	15	26.5	16.4	17.9	16.3	19.6
M.D.*	26	46	29	31	28	25
I.C.*	20	36	22	24	22	22

* S.D. = Standard deviation. M.D. = Minimum difference for significance (P = .05) between two treatments. I.C. = Minimum increase over control for significance.

The results could, of course, have been further analysed after combining annual means, but this is clearly unnecessary.

Table III shows the same results calculated in percentages of the controls.

TABLE III.

Yields expressed as Percentages of the Controls. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	112.2	83.6	140.1	143.1	154.6	140.4
PK	85.6	66.7	119.2	132.6	133.5	132.6
P	95.6	83.6	143.7	135.9	135.7	148.2
Control	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

It is clear from these figures that all manures have given significant increases over controls and that phosphatic manure alone (superphosphate or basic slag) is as efficient as the more expensive mixtures.

Reverting to the effect of magnesia, even the surprisingly large difference in 1933 between NPK + Mg and NPK is not 'significant'—the required difference being approximately 100 lbs. If the totals of all Mg and non-Mg plots are taken for the four years in which manures were acting (1931—1934) the mean yield per tree per annum without Mg is 229 pounds and with Mg 239 pounds—a small and uneconomic difference. There is, therefore, both theoretical and practical justification for grouping treatments and for neglecting magnesia from further consideration.

Tables I and II show clearly that initial inequality between plots did not tend to assist manures, but rather the reverse, the means of the control plots in 1929 and 1930 being highest.

So far, bunch weight only has been considered, manures may have acted by increasing the size of individual bunches or the numbers of bunches, or both these factors.

Table IV shows mean numbers of bunches per palm.

TABLE IV.

Mean Number of Bunches per Palm. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	5.8	6.1	8.9	9.2	8.8	5.9
PK	4.6	5.8	8.9	9.1	8.3	6.2
P	4.9	7.9	10.6	9.7	8.7	7.2
Control	*5.6*	*7.4*	*7.6*	*7.9*	*6.9*	*5.1*
Mean	5.2	6.8	9.0	8.9	8.2	*6.1*

By dividing the means in Table I by those in Table IV, mean weights of unit bunches are found to be as given in Table V.

TABLE V.

Mean Weights of Unit Bunches. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	17.4	24.3	26.3	28.2	32.6	33.7
PK	16.7	20.4	22.3	26.4	29.8	30.1
P	17.6	18.7	22.6	25.4	28.9	29.3
Control	*16.2*	*23.9*	*21.9*	*23.9*	*27.0*	*27.6*
Mean	17.0	21.8	23.3	26.0	29.6	30.2

Expressed as control = 100. Tables IV and V give approximately the figures in Tables VI and VII.

TABLE VI.

Number of Bunches expressed as Percentages of the Control. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	103	82	107	116	128	115
PK	82	78	107	115	120	121
P	87	106	139	123	126	141
Control	*100*	*100*	*100*	*100*	*100*	*100*

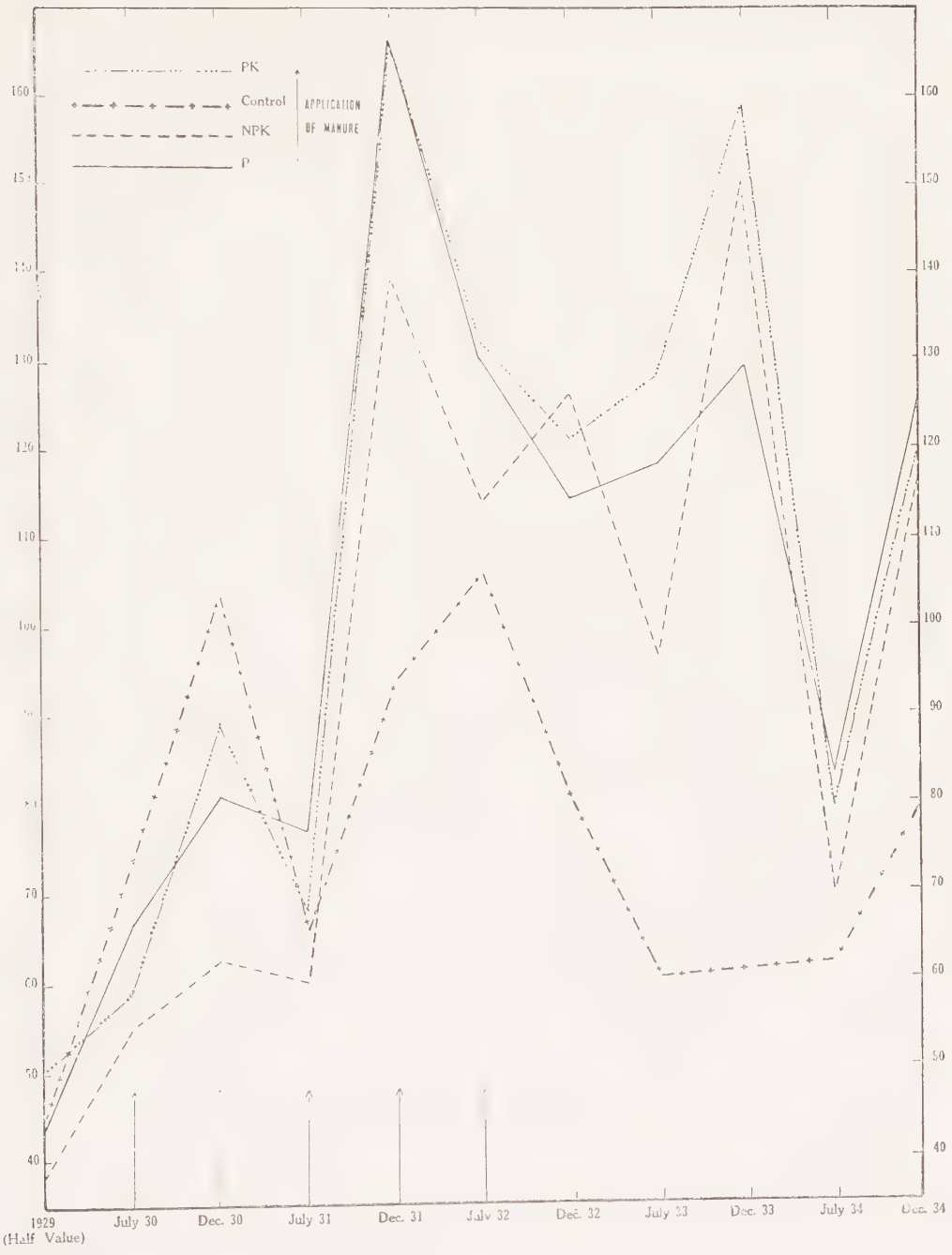
TABLE VII.

Weights of Unit Bunches as Percentages of the Control. Estate A.

	1929	1930	1931	1932	1933	1934
NPK	107	101	120	118	121	122
PK	103	85	102	110	110	109
P	108	78	103	106	107	106
Control	*100*	*100*	*100*	*100*	*100*	*100*

GRAPH I

ESTATE A. WEIGHT OF FRUIT BUNCHES.



MEAN HALF-YEARLY YIELDS.
POUNDS PER PALM.

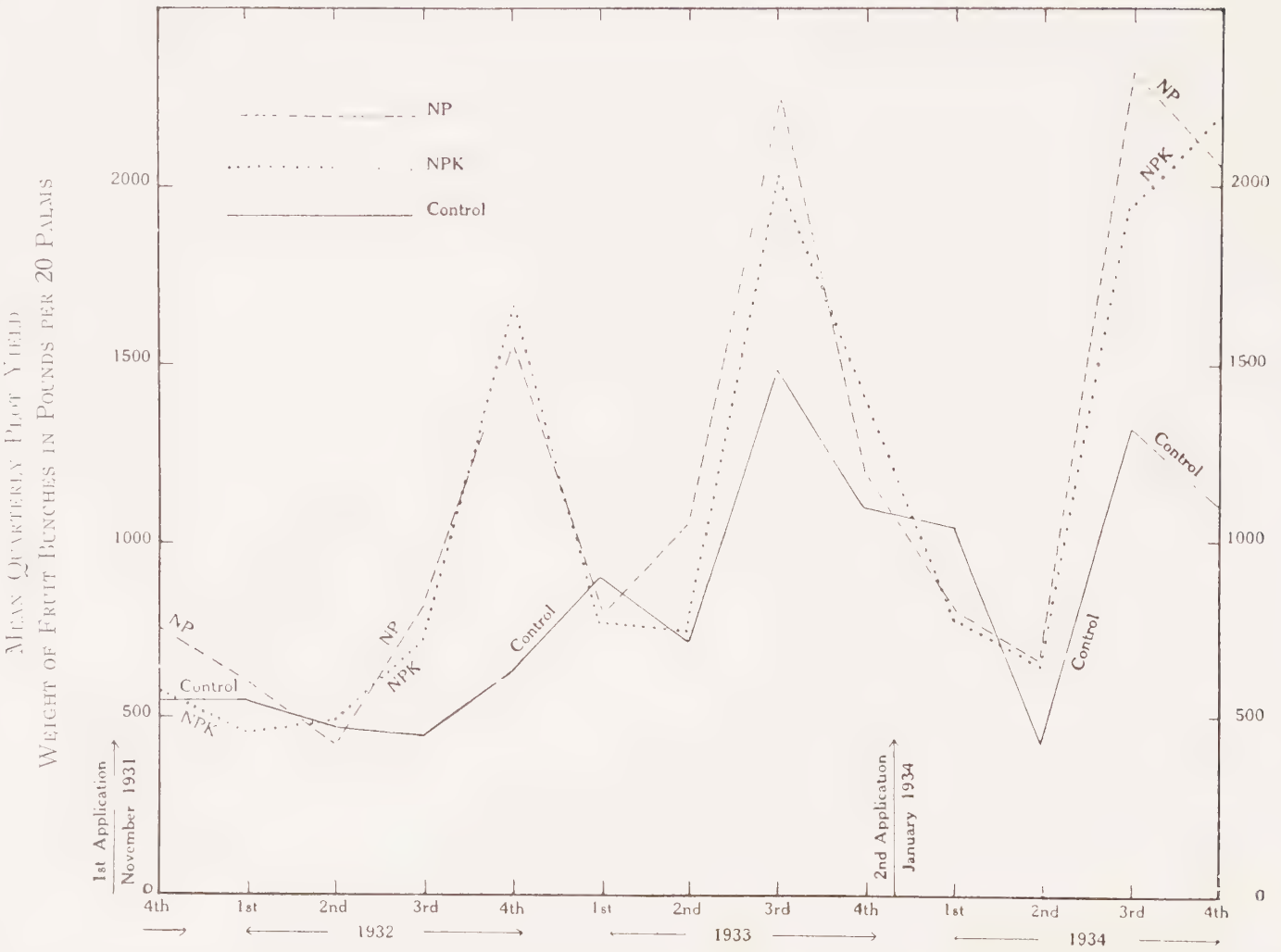
GRAPH II

ESTATE A. NUMBER OF BUNCHES PER PALM.

MEAN HALF-YEARLY YIELDS.
NUMBER OF BUNCHES PER PALM.

GRAPH III

CURVE SHOWING YIELDS FROM EXPERIMENT CONDUCTED BY MESSRS. IMPERIAL CHEMICAL INDUSTRIES (MALAYA) LTD.



From these tables it would appear that the recorded increase of bunch weight as a result of manures is a combination of the factors—number of bunches and weight of unit bunch.

The lag which occurs before the manures start acting has been studied by plotting half-yearly totals. Records for the half-years of 1929 are not now available and half the total has been taken for that year. It will be seen from graphs I and II that there was no effect either on bunch weight or number of bunches for the first twelve months but that effect was clearly indicated within eighteen months of the application. Graph III shows an earlier rise, which was also the case on Block 5 D at Serdang; in no case, however, was any rise observed during the first six months.

Individual tree records were arranged in classes in correlation arrays within each treatment in order to examine the possibility that manures act differentially on high and low yielders, as such action, if found, would be of commercial importance.

There was no evidence of differential action. The coefficients of correlation for the bunch weight totals 1931-33 against 1929-30 are :—

NPK	+	0.743
PK	+	0.418
P	+	0.401
Control	+	*0.716*

Selective application of manures (either to high or low yielders) would not be an improvement on the existing practice of uniform application.

Estate B.

The experiments on this estate have been deprived of much of their value by a rather heavy incidence of disease on the experimental plots.

There were four blocks of palms planted in 1923, of which Blocks A and C were intended to test response on light sandy soil and Blocks B and D response on organic (peaty) soil. Unfortunately, few trees per manurial treatment are left on Block A which either before or during the experiment have escaped stem-rot and consequent disease treatment; such trees obviously cannot legitimately be included in an experiment, since decreases and increases may be due to disease, shock of treatment or recovery. Scrutiny of results from this block would be useless. There was little disease on Block C, but owing to the small number of replications, three per treatment, differences would have to be great to arrive at significant responses. As a matter of fact, there is no need for analysis since manures show no results at all, *vide* Table VIII.

Table VIII.

Yields in pounds of Fruit Bunches per Mature Tree on Block C. Quartzite Valley Soil. Estate B.

Palms planted 1920.

	No. of Trees.	July-Dec. 1930	1931	1932	1933	1934
NPK	26	93	187	188	186	107
PK	21	80	167	202	177	114
P	23	109	153	171	170	125
Control	25	124	189	201	205	117

Some years ago the field in which Block C is situated was given a large dressing (approximately half-ton) of local phosphatic manure and it seems possible that residual effect may have been responsible for good control yields.

Table IX shows yields from Blocks B and D.

Table IX.

Mean Yields in pounds of Fruit Bunches per Valid Tree. Blocks B & D. Estate B.

Palms planted 1920.

Treatment		No. of Valid Trees.	1929	1930	1931	1932	1933	1934
NPK	B	17	133	149	212	247	269	197
	D	12		59				
PK	B	14	85	109	209	227	185	175
	D	14		35				
P	B	12	98	95	237	216	229	161
	D	20		56				
Control	*B*	*16*	*80*	*124*	*118*	*134*	*163*	*110*
	D	*18*		*52*				

Manures here have had marked effect, but statistical analysis is not considered legitimate in view of the considerably reduced numbers of valid trees in certain of the treatments.

As for Estate A there are no indications of any effect of nitrogen or potash. Two of the five plots in each treatment received magnesia in addition to the manure mentioned, but there are no indications of any effect. The major effect of the manures was on number of bunches and there was much less effect on weight of unit bunch.

Serdang Block 21.

There were originally three replications of each treatment arranged in three blocks, subsequently extended in July 1932 by the inclusion of four additional plots per treatment, arranged in four blocks.

Neither the original nor the subsequently added plots showed differences, significant or otherwise, between treatments or increases over the controls. Owing to the presence in the experimental area of a hard impermeable layer of very fine sand at varying depths below the surface (unsuspected when the experiments were laid down) many of the palms have become progressively poorer during the experiment and it is obviously unfair to include such palms when endeavouring to arrive at an estimate of the effect of manures. A close examination of the area was therefore made in March, 1935, and a plan prepared showing palms "good", "medium" and "poor" in appearance. The last were excluded and mean yields calculated for "good" and "medium" for each treatment. There were no real differences between these classes, and in Table X these are combined.

TABLE X.

Means Yields in pounds Fruit Bunch per Valid Palm. Serdang (21) Palms planted 1924.

(a) Original Block

Treatment	No. of Trees	1929	1930	1931	1932	1933	Jan.-June 1934
NPK	16	263	202	262	317	266	79
PK	19	221	243	305	278	276	70
P	20	237	199	227	238	176	64
Control	13	269	193	186	280	243	62

(b) Later Block

Treatment	No. of Trees	July-Dec. 1932	1933	Jan-June 1934
NPK	31	151	218	90
PK	34	143	211	97
P	29	126	243	84
Control	26	119	259	72

As there has been such wholesale elimination of trees, statistical analysis is obviously inapplicable, but it is clear that there is only a faint indication of a possible transient effect of potash in the years 1931 and 1932 and no trace of effect in the later experiment. This negative result, unsatisfactory in itself, is confirmed by experience in other manuring experiments carried out by planting companies, in which negative results have been obtained from manuring of palms 7 to 10 years old giving yields of the order of 1,500 lbs. of oil per acre.

Another conclusion to be drawn from this area is that manuring will not help palms planted on unsuitable soil—the "poor" palms have steadily become worse and the majority have entirely ceased to yield. Where palms make poor initial growth, or having made good growth, fall off heavily in yield and appearance before their seventh or eighth year, close investigation of the soil should be made before money is spent and probably wasted on manures. Valley areas contemplated for planting should be carefully examined to a depth of 5 feet for sand beds, which are common and unpleasant features of quartzite valley soils.

Records on this area have ceased as it is clear that no reliable results will be forthcoming.

Serdang (5 D.)

A larger and more ambitious experiment than any of those yet described was started in 1932 on sharply undulating quartzite hill soil at the Central Experiment Station. Plots were of 30 palms (planted May 1922) each, with five replications of four treatments and control. Manures were applied in July 1932 and consisted of the following applications per palm :—

NPK	2 lbs.	Calcium cyanamide
	6 „	Ground rock phosphate (30 per cent. P_2O_5)
	2 „	Kainit
NP	2 „	Calcium cyanamide
	6 „	Rock phosphate
P (rock)	6 „	Rock phosphate
P (basic)	6 „	Basic slag
Control		Untreated.

The intention was that half the trees (alternate rows) in each plot should have approximately ten bunches per annum artificially pollinated, and that the other half should be entirely naturally pollinated. Thus it was hoped to determine the interaction, if any, between manuring and artificial pollination. Unfortunately, artificial pollination was not reliably carried out until early in 1934; as a result only manurial results are at present available. Yields are given in Table XI.

Table XI.

Mean Yields Fruit Bunches per Palm in pounds and Percentages of the General Mean in Block 5 D at the Central Experiment Station, Serdang.

Palms planted 1922.

Treatment	No. of Palms	July-Dec. 1932	1933	1934
NPK	150	95.9	224.8	201.1
NP	150	64.3	170.4	182.5
P (rock)	150	67.7	176.4	163.0
P (basic)	150	67.5	163.9	155.6
Control	*150*	*67.3*	*124.1*	*115.7*
Mean		*72.5*	*171.9*	*163.6*

Percentages of General Mean.

NPK	132.3	130.8	122.9
NP	88.7	99.1	111.6
P (rock)	93.3	102.6	99.6
P (basic)	93.1	95.3	95.1
Control	*92.8*	*72.2*	*70.7*
Standard Deviation	28.6	22.4	24.6
M.D.	42	33	36
I.C.	34	26	29

It is known from a study of the half-yearly figures for Estates A and B that there is no effect from manures in the first six months after application even when subsequent effect is large. It must therefore be concluded that, in spite of randomisation and replication, there is considerable inherent inequality between the plots comprising the NPK treatment and the others.

These figures teach a clear lesson, *viz.*, the absolute necessity in experimental work, even with a considerable number of palms and replications, of taking preliminary yields. Had yields for the first six months not been recorded separately and the first or second year's results only been available, it would have seemed reasonably certain that application of a complete manure was a very paying proposition, since 'significant' differences had been attained!

Fortunately, there is reasonably close relationship between the yields for half 1932 and those for 1933 and 1934, "b" in the two cases being 0.73 and .62.

Recalculating results for 1933 and 1934 we have the figures of Table XII.

Table XII.
Percentages *.

	1933 *v b v*	1934 *v b v*
NPK	34	41
NP	31	57
P (rock)	35	42
P (basic)	27	37
Control	*5*	*14*
M.D.		*27*
I.C.		*22*

* A brief explanation of the use of the factor "b" will be found on page 512 of this Journal for November, 1934—the percentages shown in table XII are percentages of the general means for the years concerned

It will be seen that weighted increases over control ranged from 22 to 30 per cent. of the annual mean in 1933 and from 23 to 43 per cent. in 1934 and that there were no significant differences between the various manurial treatments—once again phosphatic manures appear to be necessary and sufficient and the relatively cheap rock phosphate has given just as good results as the more expensive basic slag.

It must be realised that deductions based on covariance involve rather a large number of assumptions, but it may be taken as fairly well established that increases of the order of 50 to 60 pounds of fruit bunch per palm have been obtained.

General.

These experiments have not yet given an answer to the minimum economic frequency with which manures should be applied. After two years' application in the case of Estates A and B and one year's application in the case of Serdang 5 D, enhanced yields have been maintained relative to the control for 1½ years without manuring. For reasons given above the experiments at Serdang on Block 21 and on Estate B have been discontinued, and the experiment on Serdang 5 D will be modified to ascertain whether manurial applications in alternate years are sufficient to maintain yield.

Another lacuna in the experiments is the fact that bunch weight only is recorded and there is at present no information on the effect of manures on the proportion of fruit to bunch. Observations on this point are now in progress at Serdang and information should be available by the end of 1935.

So far, no benefit has been found from the addition of nitrogen or potash but it is reasonable to suppose that these manures will ultimately be necessary on inland soils. The NPK treatment will be continued in the 5 D experiment at Serdang in order that early information may be available to planters of the stage at which a complete mixture should be applied.

The experiment on Estate A will be altered to provide information as to the best method of applying manures to land under cover crops.

Manuring of Young Palms.

At the suggestion of the Advisory Committee, Department of Agriculture, an experiment was started on Estate C to ascertain the effect of early manuring on subsequent yield. The experiment area is on very slightly sloping land on the hill-quartzite type of soil. The palms were planted in December, 1929, and the area is covered with a mixture of *Centrosema pubescens* and *Calopogonium mucunoides*. The height of palms and spread of foliage were measured in June 1932 and showed satisfactory uniformity of vegetative growth, there being no significant differences between means of (fictitious) "treatments". Manures were applied in July 1932 and thereafter half yearly until February 1934. Harvesting was started in November 1932 and results to the end of 1934 are given in Table XIII. There are six replications of 8-tree plots to each treatment.

TABLE XIII.

Mean Yield per Palm in pounds of Fruit Bunches — Estate C.

Palms planted December 1929.

Treatment	November 1932 to December 1933	January 1934 to December 1934
NPK	163	214
NP	166	201
N	159	190
P	134	191
Control	*144*	*184*
Mean		196
S.D		34
M.D.		42
I.C.		38

There were thus in 1934 no significant effects of manuring. It remains to be seen whether such differences will be shown later.

Manures were at the following rates per annum per tree :—

Calcium cyanamide	...	1 pound	N
Sulphate of potash	...	1 „	K
Basic slag	...	2 „	P

Summary.

An account is given of manurial experiments on mature palms.

It is shown that when yields of oil are less than approximately 1,500 pounds per annum at 8 years on normal soils of the inland types, manuring with phosphatic manures should be remunerative, and that rock phosphate is as good as basic slag for this purpose.

So far as the experiments have gone, the addition of nitrogen and potash does not appear to be necessary.

When abnormally low yields or poor condition are to be attributed to unsuitable soil conditions, manuring may be a waste of money.

The necessity for preliminary records is brought out—these should preferably be commenced 6 months before manuring.

An experiment on manuring young palms is described.

Acknowledgment.

The writers desire to express their thanks to the Agents and Managers of the Estates on which experiments have been conducted for permission to conduct them and for help freely given.

APPENDIX A.

Manurial Experiment conducted by Messrs. Imperial Chemical Industries (Malaya) Limited.

Previous History.	Virgin jungle.
Soil.	Clay loam and laterite on hillside with a northern exposure. (Soil analysis showed: Clay 30 to 40 per cent.—pH 4.7—P_2O_5 .02 per cent., K_2O .02 per cent., C/N ratio 8—11).
Cover Crop.	Centrosema, Pueraria and good grasses.

Crop.

Date of Planting.	1926.
Stand per acre.	56.
Size of plots.	About one-third acre, each containing 20 palms.

Treatments.

a. = NPK—Enpekay No. 5 (8 per cent. N, 21.5 per cent. P_2O_5 16 per cent. K_2O) 9 lbs. per tree
b. = NP—Nicifos A (13.8 per cent. N, 42.3 per cent. P_2O_5) 5 lbs. per tree
c. = O—Control (no manure)

Date of Application.

1st Dressing.	November, 1931.
2nd Dressing.	January, 1934.

This experiment has now been running for over three years. The records have been kept most carefully and the results obtained are highly satisfactory. It can be seen at a glance from the mean quarterly plot yields shown in graph III that each of the two fertilizers tried (Nicifos and Enpekay) have given similar and substantial increases in yield.

The following table summarises the yields obtained during each of the three years and also gives the mean annual yield for the period (1932—1934 inclusive), during which the fertilized plots have yielded about 40 per cent. more than the controls:—

Period	Mean Yield of Fruit Bunches in lbs. per acre.			Percentage increase over Control.	
	Control (O)	Nicifos (NP)	Enpekay (NPK)	Nicifos (NP) per cent.	Enpekay (NPK) per cent.
1932	5,888	9,649	9,498	64	61
1933	11,810	14,846	13,924	26	18
1934	10,937	16,422	15,630	50	43
Mean annual yield for the period (1932-34)	9,542	13,639	13,017	43	36

Fertilizers were applied towards the end of 1931 and at the beginning of 1934, and it is interesting to note that the percentage increases are much larger during the years following each application (1932 and 1934) than in the year when no fertilizer was applied (1933), when presumably there only remained the residual effect from the previous year's manuring. It is reasonable to conclude from this that in order to sustain the higher yield level, fertilizer should be applied to oil palms not less often than every second year.

The dressings of Nicifos and Enpekay were calculated so as to supply equal quantities of nitrogen and phosphoric acid per acre. Since there is no significant difference between the increases given by these two fertilizers it may be assumed that the application of potash is not necessary at the present stage of development of the palms. This is in accordance with the results obtained from other manuring experiments on oil palms. Unfortunately, no series of plots were manured with either nitrogen or phosphate alone so that the experiment gives no indication whether the favourable results are due to nitrogen or phosphate or the combination of the two in Nicifos. Manuring experiments in this country have generally shown that phosphoric acid is the major requirement of the oil palm in Malayan soils and applications of straight rock phosphate have often been found to give excellent results. Whether it is worth applying nitrogen as well is still doubtful.

However, there is no doubt whatever that under the conditions prevailing on this estate the application of Nicifos to oil palms is economic. Indeed at present prices the annual profit per acre on the application works out at over $36 (£4 5s).* Even at the lowest recorded price of palm oil ($67 per ton f.o.b.) there is still an annual margin of profit of $8 to $9 per acre, representing the difference in value between the increased yield of oil and the cost of manuring.

* The present price of palm oil (15 April 1935) is $155 per ton. In order to convert the yield of fruit bunches into the yield of oil a coefficient of 15 per cent. has been taken.

APPENDIX B.

Soil Analysis.

A. Physical.

		Clay Per Cent	Silt Per Cent	Fine Sand Per Cent	Coarse Sand Per Cent	Gravel Per Cent	pH Suspension
Estate A	Top	19	4	49	22	8	5.2
	Sub.	29	4	46	17	1	5.1
„ B Blocks B-D	Top	42	22	24	6	3	4.1
	Sub.	42	21	24	6	4	3.9
Estate C	Top	30	4	39	25	1	4.5
	Sub.	30	5	41	22	1	4.7
Serdang Block 21	Top	27	25	23	22	Nil	4.1
	Sub.	29	17	25	23	—	4.1
Serdang Block 5	Top	31	12	29	24	2	4.5
	Sub.	31	12	27	25	2	4.5

B. Chemical.

		Carbon Per Cent	Nitrogen	CaO	Fe_2O_3 Al_2O_3	K_2O	P_2O_5	MgO
Estate A	Top	1.33	0.077	0.077	19.5	0.173	0.020	0.029
	Sub.	0.89	0.039	0.063	16.9	0.248	0.007	0.033
Estate B, Blocks B and D	Top	2.38	0.095	0.076	11.7	0.378	0.017	0.036
	Sub.	1.58	0.053	0.062	14.8	0.050	0.031	0.031
Estate C	Top	1.43	0.095	0.060	19.4	0.191	0.027	0.006
	Sub.	1.44	0.081	0.061	17.7	0.203	0.025	0.007
Serdang Block 21	Sub.	2.19	0.137	0.030	14.3	Not determined.	0.385	Not determined.
Serdang Block 5	Top	Not determined.	0.081	0.053	8.8	0.050	0.006	0.005
	Sub.	„	0.047	0.048	11.2	0.056	0.006	0.002

Analyses for top soil Block 21 are not available; it is known from analyses of similar soil in adjacent blocks that there is little difference in composition between top and sub soil.

ANNUAL REPORT ON THE DRAINAGE AND IRRIGATION DEPARTMENT OF THE FEDERATED MALAY STATES FOR THE YEAR 1934.

The 1934 report of the Drainage and Irrigation Department, signed by F. G. Finch, Adviser, Drainage and Irrigation, Malay States, is an interesting record of the various activities of the Department during the year under review. The Department has been responsible for such widely diversified duties as the collection of hydraulic data from many parts of the country; surveys and investigations and preparation of schemes; maintenance of drainage and irrigation; conservancy of rivers including prevention of silt pollution, restoration of silted channels by dredging, flood protection, and snagging; also a number of special services including reclamation, dredging, and irrigation schemes for improving existing padi-growing areas and for the development of new areas.

Expenditure.

The total expenditure of the Department was just over one million dollars, which included nearly half a million dollars on special services, of which $243,778 was spent on the development of rice cultivation, and an additional sum of $61,326 paid by the Straits Settlements in connexion with the Krian Irrigation Extension. The programme of expenditure for the development of rice cultivation was only approved by the Secretary of State in April; in view of this unavoidable delay the progress on this work was very satisfactory.

Special interest attaches to the record of maintenance of drainage and irrigation of agricultural areas, the methods employed for the prevention of silt pollution, and the development of new areas for padi cultivation.

Surveys and Investigations.

Tanjong Karang Swamp.—Particulars are given of several important surveys and investigations of schemes. Special interest attaches to the survey and investigation of the extensive Tanjong Karang swamp in the Kuala Selangor District. The area was found to consist of peat and dead vegetation overlying clay. A detailed survey of 110 square miles of swamp on the north bank of the Tinggi River was made, consisting of a strip along the river averaging seven miles deep and extending from the foot-hills to the coast path. The foot-hills area, stretching from the Bernam River to the head waters of the Tinggi River, was found to be overlaid with 20 feet of peat.

The whole of the area surveyed was water-logged and buried under peat and dead vegetation, and the indications are that the interior of the Tanjong Karang swamp is unsuitable for padi cultivation.

The coastal strip, to a depth of four miles, is capable of development and there is a possibility of irrigating 15,000 acres from the Tinggi River.

The peat swamp in its primeval condition stores an enormous quantity of water, and investigations are necessary to determine whether this storage can be utilized for the irrigation of the coastal area.

Maintenance of Drainage and Irrigation.

Krian Irrigation Works.—Rainfall was much above the average, and the problem was more one of drainage than irrigation and was effected satisfactorily.

Sungei Manik Irrigation Area.—Although construction work on the first stage area was not quite completed, it was decided to irrigate in all areas where the water command was available. Approximately 1,550 acres of land were planted with padi and a further 900 acres were in course of planting at the end of the year, but the crops are expected to suffer on account of lack of organization amongst the planters. The new irrigation works, where tested, were efficient and satisfactory. Great trouble was experienced and expense incurred on account of damage caused by a herd of fourteen elephants.

The question of colonization of the area received consideration by the State Irrigation Board and recommendations were made as to the standard size lots for single families and of those for family or racial groups.

In regard to colonization of the area, 4,000 acres have been surveyed, 1,000 acres are awaiting survey, and 3,170 acres have been alienated. Padi was planted on 1,947 acres.

In Selangor, Negri Sembilan and Pahang other maintenance services of a minor order were rendered by the Department.

Prevention of Silt Pollution.

The main sources of silt pollution are two-fold; hill workings for tin with their tailings dumps, and erosion from agricultural lands. These two sources, especially the former, are so serious that any other causes need not, at present, be considered.

The technique of river training, as applied by the Department, has been evolved from experimental work at Bentong, Pahang, which was started in the year 1917.

At the time the experiment was started, the natural channel of the Bentong River in the vicinity of Bentong town had become choked with silt contributed by its tributaries the Perting, Chamang and Repas rivers, and its waters were spread out over the whole valley. The tributaries had silted 30 feet deep. In 1924 Government built a dam for the retention of tailings in the Perting gorge and in 1927 another was built in the Repas gorge. While these dams prevented the flow of silt above them, the silt below continued to move down the gorges, to be deposited where the waters debouch on the Bentong flats. As the miners' tailings reservoir in the Chamang was filled up, there was no hope of relief from silting at Bentong for many years.

The retention of silt on the Bentong flats is effected by training fences of bamboo stakes, five feet in length, driven into the silt to about half their depth at nine inches apart and wired at the top to a longitudinal bamboo runner. These fences erected over the whole of the valley bottom retard the velocity of the silt-laden tributary waters before entering the main channel for which a gap is left in the fences and the silt is thereby deposited and forms banks. Grasses grow fairly quickly on and near the newly formed banks, but on the silt flats the grasses grow at first only along the lines of the fences where dead leaves brought down by waters accumulate. In passing through this dead matter, fine silt in suspension is deposited which helps the growth of vegetation. This new vegetation in turn helps to hold up the waters on the flats and thereby increases the deposit of fine silt over the whole of the valley so that in time the area, which before training was the bed of the silted river with its waters spread out in rivulets over the whole valley, returns to meadow land with the river running through it in a defined channel.

Since this experiment in silt retention was started in 1927, over 400,000 cubic yards of silt have been reclaimed from the waters of the Perting, Chamang and Repas rivers forming new banks for the Bentong River 4 to 6 feet high where previously there were none. The Bentong River, relieved of the mining silt of these tributaries, has scoured a deeper channel. Water levels have been lowered nearly 3 feet. The Bentong town outlet drain has been relieved of back water and there is a marked improvement in the amenity of low-lying areas within Sanitary Board boundaries. At the Repas Road bridge where the training works commence, the standard section of the river showed an average level of 335.44 feet above sea-level at the end of the year against 336.43 at the beginning—a scour of 12 inches in 12 months. At the Kuala Lumpur Road bridge, the lower end of the training works, the average bed level in January was 293.72 and in December 293.94.

The striking improvement in the Bentong River near the upper end of the training works as compared with the lower end, is undoubtedly due to the fact that practically the whole of the silt carried by the Repas waters is trapped. No attempt is made to train the waters of the Repas (a lesson from the experiment), whereas at the lower end the Perting was trained to a defined channel in the earliest stages of the experiment and this channel carries a considerable load of silt into the Bentong River.

Special Services.

Several schemes of reclamation, dredging, pumping, irrigation, drainage and bunding have been put in hand, many of which will be of direct and considerable value to agriculture. The more important of these schemes are outlined below.

First Pumping Scheme, Perak River Areas, Bota and Lambor Kanan, Perak. This scheme was nearing completion at the end of the year, the only outstanding item being completion of installation of the pumping set. The

total cost of the scheme is $31,284 and it will supply water to an area of 2,573 acres, consisting of 2,026 acres already under cultivation, and 547 acres of potential padi land. The capital cost will therefore be $12 per acre.

Krian Irrigation Extension Scheme.—The total estimated cost of this scheme is $375,000, which will be borne in equal shares by the Straits Settlements and Perak. Expenditure at the end of 1934 was $122,651. The work carried out was: increasing capacity of main canal; extension to Sungei Acheh area in Province Wellesley; and extension to Kurau Forest Reserve area.

The scheme provides for increased supply of irrigation water by diversion of the waters of the Sungei Ijok to Bukit Merah Reservoir, extension of irrigation to 4,550 acres of existing padi lands in Province Wellesley; extension of irrigation to a new coastal area embracing approximately 3,000 acres; extension of irrigation to a new area of approximately 750 acres near Bukit Merah and general improvement in supply to the whole of the area comprised in the existing schemes.

The area covered by the existing works amounts to approximately 50,000 acres and with the extensions now in hand this will be increased to 60,000 acres.

Sungei Manik Irrigation Scheme (First Stage), Perak.—Work was completed this year but on account of the decision by Government to undertake the construction of the small distributaries, that part of the scheme is being done from second stage funds. *Tali ayer* No. 2 was completed in June and *tali ayer* No. 1 in November. Where practicable, irrigation water was supplied from the beginning of October and the scheme worked satisfactorily. Jungle clearing in the distributary reserves was completed as far as funds available would permit, but as the cost of this work was increasing throughout the year the work could not be quite completed.

The total cost of this work to the end of 1934 was $60,409.

Sungei Manik Irrigation Scheme (Second Stage). This consists of various works put in hand in connexion with the opening up of the area. It includes jungle clearing on the line of the river bund reserve on the right bank of Sungei Batang Padang and on the line of the main distributary canal behind the bund; the construction of a bund on the right bank of the same river for a length of about 480 chains; and jungle clearing and the construction of a distributary canal near Sungei Batang Padang Mati. Expenditure for work at second stage was $31,418.

Controlled Drainage Scheme, Panchang Bedena Padi Area, Selangor.—The construction of the main drain was completed in September and resulted in much improved water control and access within the area. Work is continued on certain subsidiary drains, and the outer bund remains to be completed. All the control gates required were completed and those constructed previously functioned satisfactorily.

There have been constructed, in all, four main water control gates and 20 subsidiary gates, 12½ miles of main drain and bund, 35¼ miles of subsidiary

drain and bund and $1\frac{3}{4}$ miles of outer bund. The total expenditure on the scheme to date is $230,451.

Planting in the southern half of the area, where all the construction work has been completed, appeared to have been started late and the various operations of preparing the ground for planting to lack co-ordination. There were stumps and timbers left in areas that were planted last year which should have been systematically burnt off during the dry weather. It would help considerably if each section of the drainage area were developed systematically. Without an efficient system of internal bunding of the fields, the higher ground will suffer when water has to be drained from the lower ground. More co-operation is desirable so that cultivators have their lands prepared in time, systematically, before the rainy season sets in.

Irrigation of Padi Areas, Sungei Blat, Kuantan, Pahang.—This controlled drainage scheme was commenced in 1932. The total area included within the bunds to date is 1,171 acres. Unfortunately, many people in the area have relinquished their land held under temporary occupation licence during the year, and this is thought to be due to the rise in price of rubber, when the people are no longer dependent for food on their own rice crop.

Special attention is being given in the lay-out of the rice-land area to interlink it with the lay-out of the "kampong" land.

In connexion with the working of the scheme, the people concerned, with only one or two exceptions, have never planted padi in any area as large as this and cannot understand the method of water control. In order to explain it more easily to them, a working model of the scheme has been made and several demonstrations have been given.

The above abstracts give information on the main lines of the work of the Drainage and Irrigation Department, which affect agriculture, but lack of space precludes reference to a number of minor works in all parts of the Federated Malay States, which will assist materially in improving agricultural land, especially in padi areas.

TWENTY-SECOND REPORT ON NATIVE RUBBER CULTIVATION IN THE NETHERLANDS INDIES*.

First Quarter 1935, and including developments in April and May.

Prices.

The price development during the first quarter of 1935 was disappointing. The high consumption figures of the United States of America during January justified the assumption that still greater quantities of rubber would be consumed during the subsequent months under the influence of the normal seasonal increase. This increase did not materialize and consumption in Europe was also disappointing. The expectation that the International Rubber Committee would raise the restriction percentage held the price up in February, but when it became apparent that the restriction percentage for the 2nd quarter would be maintained at 25 per cent., and would only be increased to 30 per cent. at the beginning of the 3rd quarter, prices fell off considerably. Java standard sheet in Batavia dropped to 15½ cents per ½kgm. on March 26th. This disappointing reaction caused the International Rubber Committee to revise its decision and the restriction percentage for the second quarter was raised from 25 to 30, and that for the second half of the year 1935 to 35 per cent. The Batavia market price immediately jumped to 17⅞ cents, after which it again weakened, 16¾ cents per ½ kgm. being quoted at the end of the quarter.

The following are the half-monthly average prices in cents per ½kgm. of Java standard sheet in Batavia:

First half January	19.7	Second half March	16.3
Second half January	19.0	First half April	16.75
First half February	19.0	Second half April	17.3
Second half February	19.1	First half May	17.1
First half March	17.7	May 28th	19.25

The premium paid for crêpe rubber above the price of sheet disappeared entirely; occasionally sheet yielded a higher price than crêpe, while the price of medium blanket amounted to approximately 85 per cent. of that of standard sheet in the first quarter of 1935 and increased to around 92 per cent. in April and May 1935.

The increasing preparation of native smoked sheet has led to increasing competition in the remilling industry, with the result that the prices which the natives are now receiving for their product are relatively higher in comparison with the standard estate product than they were at the commencement of restriction.

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* Abstracted from a Review under the same title published in *The Netherlands Indies*, Vol. III No. 12, June 15th, 1935; also abstracts from an article "The Development of the Native Rubber Situation in April and May 1935" contained in the same publication.

† Throughout this Abstract, cents refer to guilder cents, and tons to metric tons.

Exports.

The exports of native rubber for the first five months of 1935 were, in metric tons :—January 9,817, February 17,184, March 9,042, April 13,809, May 22,434 (provisional). The alloted export quota of 31,769 tons for the first quarter was exceeded by 4,200 tons, while the amount exported in excess of the quota was 3,920 tons in April and 12,510 tons in May.

During the first quarter no changes were made in the extraordinary export tax on native rubber, which had been retained at 16 guilder-cents per kgm. of dry rubber since December 16th, 1934. The large exports in April, and the price advance in May, led the Government to raise the tax to 18 cents per kgm. effective on June 1st, and to 20 cents effective June 16th. The large excess exports in May and the increased price, caused a further rise in the tax to 22 cents to take effect on June 16th instead of the 20 cents previously decided upon.

The high exports are stated to be caused by the following reasons :—

i. Price advance in April and May which could not be caught up with quickly enough by the rise in the extraordinary export tax. This resulted in stimulating production.

ii. A favourable period for tapping, as the natives were not particularly engaged in other seasonal occupation at the time.

iii. Relative price improvement of "blankets" in comparison with standard sheet, which stimulated production.

iv. Due to the rise in the extraordinary export tax effective June 1st, forced exports from stocks took place in May.

In view of the further increase in the extraordinary export tax on June 16th, further extensive exports from stocks may be expected in June.

Quality of Rubber.

The percentage of dry rubber assumed to be present in native wet rubber (the conversion percentage) was increased from 85 to 90 for Bengkalis, Sumatra's West Coast, Indragiri, Djambi, Palembang and the Southern and Eastern Divisions of Borneo, effective March 1st 1935.

The quality of native rubber exported in the form of dry rubber (blankets, smoked sheets, sheety crêpe) represented 45½ per cent. of the total exports in January, 34 per cent. in February, 65½ per cent. in March, 60 per cent. in April and 46½ per cent. in May.

Although the share of dry rubber, as shewn in monthly reports, fluctuates considerably—attributable to the effects of increases in the conversion percentages, the variations in the amount of the extraordinary export tax, and the introduction of individual restriction—it is certain that the percentage of dry rubber exported has shewn a slow but steady improvement. This improvement is more apparent by a comparison of quarterly than of monthly figures. The percentage of dry rubber in the total exports of native rubber (calculated as the dry equivalent) was 15½, 20½, 39½ and 43 respectively in the consecutive

quarters of 1934, while for the first quarter of 1935 the percentage rose to 45.

The exports of dry rubber have been divided into two groups since October 1934; namely, Ia and Ib. Group Ia comprises blankets, bark crêpe and similar rubber in sheets prepared by means of machines other than those driven by hand; these are therefore products of the remilling industry.

Group Ib includes all other rubber in sheets, the section of which shews either no milk-white colour or a milk-white coloured area less broad than one-half of the thickness of the sheet. This group embraces the native sheet and the sheety-crêpe. All the rubber in this group is still unsuitable for direct handling in the world markets of Europe and America. A large portion goes to Singapore, where many sheets are re-smoked and re-sorted in smoke-houses specially built for the purpose, while the worst is re-processed into "blankets". Thanks to the propaganda launched in various parts of the country for the preparation of a directly marketable product, the quality of native sheet rubber is now steadily improving. The two Divisions of Borneo strike the keynote in this respect, the Southern and Eastern Divisions, in particular, already producing a very good product. The shares of group Ia and Ib in the total exports are almost equal.

Individual Restriction.

Information was given in the last quarterly report of the individual restriction scheme introduced in Acheen and Dependencies, the Residency of Tapanuli and the estate area of the Government of Sumatra's East Coast. The following table gives the results of the tree registrations.

Census of Trees in Certain Regions of the Outer Islands.

Region	Number of Producers	Trees Tappable		Total Number of Trees	Quota per Tappable Tree in kgm. per annum.
		Tapped	not tapped		
Acheen	5,688*	1,893,766	1,485,116	?	0.32
Tapanuli	43,885	10,264,762	6,480,659	32,886,602	0.35
Estate area of S.E.C.	39,771	13,830,000	6,530,000	82,219,003	0.61
Free area of Riouw	8,956	4,151,102	3,598,910	13,022,908	0.77
Banka and Dependencies	25,183	6,243,726		13,636,360	0.23

* Not including 12,222 owners of exclusively non-tappable trees.

The total alloted exports from the districts with individual restriction, from January to May inclusive, amounted to 3,458 tons, whereas the actual exports against this quota have totalled 2,909 tons.

Future Production.

With the price relationships the same as they were a year ago, and before then, the impulse to produce on the part of natives has become far stronger. In addition, this is primarily attributed to many young plantations dating from 1925 and subsequent years, either becoming productive or augmenting in productivity. The number of productive small holdings has therefore considerably increased recently, in addition to which their productivity has also improved from year to year. The importance of the small-holding owners in the production apparatus is, therefore, constantly becoming greater, and it is this group, which works with the cheapest possible production costs, that is causing the rising pressure of production, and will continue to produce even when prices are quite low.

The problem with which the Government is faced of controlling production, especially in view of the present application of higher restriction percentages on the fixed quota, is made by no means simpler by the change which is taking place in the structure of native rubber cultivation.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports submitted by Field Officers.

June, 1935.

The Weather.

Rainfall during the month of June was well above the average in Malacca, Batang Padang and Lower Perak Districts, and about average in the remainder of the Peninsula.

Remarks on Crops.

Rubber.—There was on the whole a slight upward trend of prices with some local weakening in Kinta. There was general decrease of tapping except in the Kluang District due to diversion of labour to padi planting and fruit harvests, exhaustion of coupons at the end of the quarter and sale of coupons.

A European-owned estate has been observed to provide its coolies with stools to enable them to tap at heights of 6 feet.

It was noted in Tanjong Malim that numbers of small-holders have their sheet smoked in Malay and Chinese-owned smoke houses at a charge of 50 to 75 cents per picul. Interest was manifested in the Temerloh, Pahang, Ulu Selangor and Muar Districts in small-holders' smoke cabinets.

Cleaning up of holdings to avoid reduction of assessment continues.

Padi.—Activity was manifested over most of the Peninsula and ranged from clearing of land in the late districts to transplanting in the early. There was some retardation in North Krian and North Johore due to shortage of water. This shortage was due in Krian to work on the Sungei Acheh extension scheme and in Johore to low rainfall. Elsewhere water was sufficient and in Briah and Semanggol in Krian, longer-term (and heavier-yielding) varieties of padi are replacing short-term ones owing to improved water supply. The pumping scheme installed by the Drainage and Irrigation Department at Bota in Perak Central was tried out and functioned satisfactorily.

Very satisfactory yields were recorded from the Panchang Bedina area—crop-cutting tests shewing returns of well over 500 gantangs per acre. Rats in this area are abundant, and a very active campaign must be envisaged against them.

As a result of a visit of selected cultivators from Temerloh District to Malacca and of a vigorous campaign by the District Officer, great interest is being shown in the former District in the use of plough and harrow; bunds are also being freely constructed.

In Pahang East there is increased application for land at Sungei Blat.

In Perak nearly 9,000 gantangs of selected high-yielding pure strain padi have been distributed to cultivators for sowing, while in Malacca demand for such padi greatly exceeds supply.

Arrangements have been made in Krian for large scale planting of S.K. 48, a pure strain which has given excellent results for the past three years at Titi Serong Station and other Test Plots in the District.

An aerial inspection of the Sungei Manik area provided useful information on progress.

Copra.—Prices for copra declined to some extent in all districts except North Johore but there was less variation in the price of nuts for eating. In Krian a considerable amount of sun-dried copra was prepared. Good quality copra was made during the initial run of the Kuala Kurau improved kiln; an improved kiln at Besarah in Pahang was completed.

In Kuala Selangor there is widespread, direct extraction of coconut oil by small-holders for home consumption and in Kuala Langat a certain amount of such oil is sold at weekly fairs. At Matang Road (Perak) an ingenious home-made mechanical rasper was observed which utilized a motor cycle wheel filled with cement as a flywheel. The output of oil was 6 pints and the profit about 27 cents per day of 5 hours.

Pineapples.—In Johore the fruiting season is nearing its end and all canneries are working shorter time. In Singapore fruits are still fairly plentiful. Prices for fruits have risen both in Johore and in Singapore.

Miscellaneous Crops.—There was a heavy crop of coffee at Ulu Langat and a very fair product was turned out in Kuala Langat. Gambier supplies are short. Cocoa at Bentong, Pahang, is making good progress. A tapioca factory was opened at Segamat, Johore.

Fruit.—There was generally a good season for durians which is drawing to a close in many Districts. Small fruit are now coming in.

Tobacco.—There was some expansion of area in the Sungei Siput, Perak South and Jerantut, Pahang, Districts but diminution was reported from Perak East and Segamat, Johore. Prices have eased and trouble was experienced in Perak South with stem-borer and mosaic disease.

Agricultural Stations and Padi Test Plots.

Routine work was carried out. Improved growth was observed at Selama, Perak, especially on an area under experiment with a view to improving a somewhat infertile soil. There was a large local demand for marcots from Kuala Kangsar Station.

The newly planted area for manurial experiments at the Pineapple Station, Singapore, is doing well and arrangements for a trial of a fertilizer prepared from town refuse by the Municipality were completed. There is considerable demand for planting material of fruit trees. Interest was manifested in the Farm School in process of erection in Malacca.

Agricultural Shows and District Padi Competitions.

Padi competitions were held in Province Wellesley, at Pengkalan Bharu in the Dindings, and at Lipis, Lanchong, Temerloh and Kuantan in Pahang, Many of the exhibits at Pengkalan Bharu were excellent, reflecting great credit on cultivators who harvested under difficulties due to heavy rain, but those in Province Wellesley and Pahang were somewhat disappointing in quality and quantity, especially at Kuantan. It is hoped that the Test Plot at Sungei Blat will show the way to improvement.

Rubber competitions were held at ten centres in the Seremban District; quality in some cases was excellent. The commonest faults were inclusion of sand, insufficient rolling, oxidization and bubbles.

Rural Lecture Caravan.

A successful tour of the Raub and Lipis Districts was made. Attendances at these centres totalled 3,200.

Poultry.

Interest in poultry was maintained. There were outbreaks of disease in Selama, Perak, and Pekan, Pahang.

DEPARTMENTAL NOTES.

Leave of Adviser on Agriculture.

Dr. H. A. Tempany, C.B.E., Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, has been granted leave from 26th June to 3rd September 1935. Mr. F. W. South, Chief Field Officer, will act for Dr. Tempany during his absence, while the duties of Chief Field Officer will be performed by Mr. W. N. C. Belgrave, Chief Research Officer, in addition to the duties of his substantive appointment.

Appointments.

Mr. A. E. Coleman-Doscas, Agricultural Field Officer, has been appointed State Agricultural Officer, Johore, with effect from 23rd February 1935.

Mr. A. de K. Frampton, Dip. Agr. (Seale Hayne), Agricultural Superintendent, Agricultural Department, British Guiana, has been appointed Agricultural Officer S.S. and F.M.S., with effect from 15th May, 1935. He arrived in Malaya and assumed duty on 16th June 1935.

Visits of the Adviser on Agriculture.

Dr. H. A. Tempany, C.B.E., visited Johore between June 11th and 13th for the purpose of inspecting and reporting on the position in relation to sites for the projected Central Experiment Station in that State. He also visited Malacca on his return from Johore.

Instruction of Asiatic Rubber Instructors.

A two months' intensive course of instruction to newly-appointed Asiatic Rubber Instructors terminated at the end of June. The course was held partly at the School of Agriculture, Malaya, at Serdang, and partly at the Rubber Research Institute of Malaya at Kuala Lumpur and on the Institute's rubber plantation at Sungei Buloh, Selangor. These Asiatic officers have since assumed duty in various parts of the country.

Leave.

Mr. J. Lambourne, Assistant Agriculturist, returned from leave on 4th July 1935.

Retirement.

Mr. W. N. Sands, F.L.S., Principal Agricultural Officer, Kedah, retired from the service on 17th May 1935. Mr. Sands' service for tropical agriculture covered over 35 years. From 1899 to 1920 he served as Curator, Botanic and Experiment Station, Antigua, and later as Agricultural Superintendent, St. Vincent. In 1920 he was appointed Assistant Economic Botanist, Department

of Agriculture, Straits Settlements and Federated Malay States, a post which he held until 1930; during this period he frequently acted as Economic Botanist.

He retired from the Federated Malay States service in 1930 on reaching the age limit, but his services were secured by the State of Kedah where he became Principal Agricultural Officer.

Mr. Sands leaves behind a valuable record of work on various aspects of tropical agriculture.

His former colleagues in this Department wish him many happy years in his well-earned retirement.

KELANTAN AGRICULTURAL SHOW.

The Third Annual Kelantan Agricultural Show was held at the Central Experiment Station at Kota Bharu on Sunday, 16th June, 1935. As in previous years, the show comprised 41 classes distributed among six sections. Particularly heavy entries were forwarded in the classes relating to wet and dry padi and rice and the exhibits in these classes were all up to a high standard. In the section devoted to fruit, the general quality was poor owing to the apparently ingrained habit of the local people of harvesting produce some time before it commences to ripen; winning exhibits in citrus classes were, however, of excellent quality, worthy of propagation. The vegetable section provided a number of good exhibits in all classes. Copra classes—both kiln and sun-dried—were of exceptionally high quality while coconut and groundnut oil classes appearing in the same section were well filled with exhibits of good quality.

During the morning and early afternoon a variety of demonstrations were given by the staff of the Department of Agriculture. These included: manufacture of high quality sheet rubber under kampong conditions; construction and use of a smoke cabinet for small-holders; housing, feeding and feeding appliances for poultry; manufacture of copra; destruction of rats by use of Capex fumigators; crops grown on the Central Experiment Station. Keen interest was shewn in all demonstrations, the rubber smoke cabinet and poultry being particularly popular. Unfortunately, very heavy rain in the afternoon prevented spectators from moving about, and numbers failed to see all the demonstrations.

His Highness the Sultan, accompanied by H.H. The Raja Kelantan, visited the Show and took this opportunity of examining a number of developments on the Central Experiment Station.

The attendance was not so large as at the original show held in 1933, but a lively interest was displayed during the fine portion of the day and the improvement in quality of exhibits over those of 1933 was most remarkable.

Statistical.

MARKET PRICES.

June, 1935.

Rubber.—The market remained steady during June with only slight fluctuations. Spot loose opened in Singapore at 20 1/8 cents per lb. and closed at 20¼ cents; towards the end of the month the price fell for one day to 19 13/16 cents. The Singapore average price for June for No. 1. X. Rubber Smoked Sheet was 20.35 cents per lb. as compared with 19.59 cents per lb. in May. The average price in London for the month was 6.04 pence per lb., and in New York 12.47 cents gold per lb., as compared with 5.84 pence and 11.96 cents gold in May.

Prices paid for small-holders' rubber at three centres during the month are shewn in the following table.

Table I.
Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, June, 1935.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.			Kuala Kangsar, Perak.			Batu Pahat, Johore.		
	6	13	20	5	12	26	12	19	26
Smoked sheet	24.59		25.00	23.92	24.05	23.68			
Unsmoked sheet	23.66	22.00			23.00	22.50	22.22	22.00	21.73
Scrap									

Transport by F. M. S. R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent

No purchases at Kuala Kangsar on the 19th June, at Batu Pahat on the 5th June, and at Kuala Pilah on the 27th June.

Palm Oil.—The market weakened during the month, and the following table gives quotations for the Malayan commodities.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1935.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
May 31	£ 21. 10. 0	£ 8. 15. 0
June 7	21. 0. 0	8. 15. 0
„ 14	20. 0. 0	8. 15. 0
„ 21	20. 0. 0	8. 5. 0
„ 27	19. 0. 0	8. 0. 0

Copra.—Prices in Singapore declined steadily throughout the month. The sun-dried grade opened at $4.60 per picul, and, after rising in the first half of the month to $4.70, fell rapidly to close at $3.95, averaging $4.40 per picul as compared with $4.87 in May. The mixed quality followed the trend of the better grade and averaged $4.05 as compared with $4.53 in the previous month.

Copra cake continued to improve in price, the average for the month being $1.40 per picul as compared with $1.23 in May.

Rice.—The average wholesale prices of rice per picul in Singapore for May were as follows:—Siam No. 2 (ordinary) $4.77, Rangoon No. 1 $3.77, Saigon No. 1 $4.05, as compared with $3.97, $3.41 and $3.87 in April. Corresponding prices in May 1934 were $2.60, $2.42 and $2.50.

The average retail market prices in cents per gantang of No. 2 Siam rice in May were:—Singapore 32, Penang 20, Malacca 30, as compared with 28, 20 and 26 respectively in April.

The average declared trade value of imports of rice in May was $3.97, as compared with $3.62 in April and $3.46 in March.

Padi.—Prices per gantang ranged from 5 to 13 cents in June in different parts of the country. The Government Rice Mill, Bagan Serai, continued to pay $1.90 per picul for padi, and the privately-owned mill at Parit Buntar maintained its price of $2.25.

Tea.—Consignments of tea from Kedah and Cameron Highlands were sold on the London market during June. The former averaged 9¾d. and 10d. per lb., and the latter 11¼d. per lb.

Average London prices per lb. paid during June for tea consignments from other countries were as follows:—Ceylon 1s. 1.11d. Java 9.86d., Indian Northern 11.4d., Indian Southern 11.79d., Sumatra 8.52d.

The following are the latest Colombo average prices available and are quoted from the *Weekly Tea Market Report,* 25th June 1935, of the Colombo Brokers' Association; prices are in rupee cents per lb.: High Grown Teas 62 cents, Medium Grown Teas 56 cents, Low Grown Teas 53 cents, Straits Tea (Jugra Land) 45 cents, F.M.S. Tea (Tanah Rata) 51 cents.

Tuba Root (*Derris*).—Supplies of roots sold on a basis of rotenone content continue to be scarce, and the average price for the month in Singapore remained unchanged at the May average of $53 per picul. Roots sold on a basis of ether extract also maintained the May average of $42 per picul and non-Malayan roots continued at $32 per picul.

Coffee.—There was little change in Singapore prices of coffee during June. Sourabaya coffee opened at $14 to $15 per picul and closed at $14.50 to $15, after a rise to $15 to $16 per picul. Palembang coffee averaged $11.19 per picul as compared with $11.25 in May.

Local prices for coffee shewed considerable variation, ranging from $12 to $33 per picul.

Arecanuts.—Singapore average prices per picul for June were:—Splits $3.79 to $6.31, Sliced $7.50 to $8.50, Red Whole $5.71 to $6.56, Kelantan $5.75 to $6, the price in each range depending upon quality.

The average prices per picul quoted by the Singapore Chamber of Commerce were:—Best $5.85, Medium $5.17, Mixed $4.96.

Gambier.—Block remained unchanged at $6 per picul, but No. 1 Cube weakened slightly, averaging $10.20 per picul as compared with $10.50 in May.

Pineapples.—Prices per case in Singapore continue to be fixed by the Packers' Combine; they are Cubes $3.35 an increase of 10 cents—Sliced Flat $3.15, Sliced Tall $3.40.

There was an improvement in the prices paid for fresh fruits. Prices per 100 were: Singapore, $2.70 for large, and $2 for small fruits; Johore, 1st quality $2 to $5.50, 2nd quality $1 to $3.50, 3rd quality 60 cents to $3; Selangor, 70 cents to $1 according to quality.

Tapioca.—There was no change in Singapore prices per picul as compared with May; they were:—Flake Fair $4, Seed Pearl $5.40, Medium Pearl $6.

Sago.—Pearl, Small Fair, weakened slightly to average $3.85 per picul as against $3.93 in May. Flour, Sarawak Fair, averaged $2.26 per picul as compared with the previous month's average of $2.24.

Mace.—Siouw fell considerably during the month, to average $80.20 per picul as against $93.25 in May. Amboina also fell, averaging $60.40 per picul as compared with $61.25 in the previous month.

Nutmegs.—The Singapore market for 110's weakened during June to average $27.80 per picul as against $28.50 in May. There was an improvement in 80's, the average price per picul being $31.40 as compared with $29.50 in May.

Pepper.—Values are nominal with little enquiry, and prices have been further marked down. Average Singapore prices per picul during June were :—Singapore Black $11.40, Singapore White $19.60, Muntok White $20.60. The May averages were $12.44, $23 and $24 respectively.

Cloves.—Prices in Singapore, although quoted as nominal, improved during June, averaging $35.60 per picul for Zanzibar and $36.40 for Amboina. May averages were $34.50 and $35.50 respectively.

Cardamoms.—According to the Ceylon Chamber of Commerce weekly reports, cardamoms, green, were quoted during June at 90 rupee cents to R. 1.05 cents per lb. falling at the close to 85 to 98 rupee cents per lb.

Tobacco.—Prices per picul in Perak were :—1st quality $60, 2nd quality, $30 to $40, 3rd quality $25 to $30. Prices elsewhere in the country ranged from $15 to $50 per picul, Java tobacco being sold in Johore at $50 to $80 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Mackay & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

May, 1935.

Malaya.—Imports of foreign rice into Malaya in May were 55,769 tons, and exports 14,359 tons, net imports being 41,410 tons. Net imports for the period January to May, 1935, totalled 186,374 tons, an increase of 0.1 per cent. as compared with the previous year.†

Of the May imports, 49 per cent. were consigned to Singapore, 20 per cent. to Penang, 6 per cent. to Malacca, 20 per cent. to the Federated Malay States and 5 per cent. to the Unfederated Malay States. Of the total, 55 per cent. came from Siam, 40 per cent. from Burma, 4 per cent. from French Indo-China and 1 per cent. from other countries.

Of the exports during May, 74 per cent. were consigned to the Netherlands Indies and 26 per cent. to other countries. The various kinds of rice exported were as follows:—Siam 9,138 tons (63.6 per cent.), Burma 4,164 tons (29 per cent.), French Indo-China 502 tons (3.5 per cent.), parboiled 423 tons (3 per cent.), local production 132 tons (0.9 per cent.).

India and Burma.—Foreign exports for the period January to April, 1935 totalled 774,000 tons, an increase of 32.1 per cent. Of these exports 4.8 per cent. were to the United Kingdom, 10.5 per cent. to the Continent, 19.8 per cent. to Ceylon, 34.7 per cent. to the Straits Settlements and the Far East, and 30.2 per cent. to other countries. The 1934 percentages were 13.3, 19.3, 22.4., 19.4, and 25.6 respectively.

Burma's total exports of rice and bran (*Bangkok Times*, 10th June, 1935) from 1st January to 27th April, 1935, aggregated 1,432,463 metric tons, a decrease of 0.8 per cent. as compared with 1934.

Siam.—Exports of rice and rice products from Bangkok for the period January to April 1935 totalled 597,962 tons as compared with 578,828 tons in 1934.

According to the *Straits Times* (3rd June 1935) the Siamese rice-milling trade faces a critical situation. Market prices of padi are rising; mills are unable to produce rice in accordance with their export contracts, and several have been compelled to close.

Japan.—The latest information available was published in the Summary for March, 1935.

French Indo-China.—Entries of padi into Cholon during the period January to May 1935 amounted to 985,554 metric tons, an increase of 64.7 per cent. Exports of rice for the same period increased by 55.2 per cent. as compared with 1934, to 1,031,969 metric tons.

The Netherlands Indies.—The area under padi in Java and Madura (*Economic Bulletin*, 16 March 1935) harvested for the year 1934, amounted to 9,200,750 acres as compared with 9,351,420 acres in 1933.

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* Abridged from the Rice Summary for May 1935, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1934.

Ceylon.—Imports for the period January to May, 1935, totalled 220,373 tons, an increase of 13 per cent. as compared with 1934. Of the 1935 imports 11.6 per cent. were from British India, 70.4 per cent. from Burma, 1.4 per cent. from the Straits Settlements, and 16.6 per cent. from other countries. The corresponding 1934 percentages were 20, 72.6, nil, and 7.4.

Europe and America.—Shipments to Europe from the East for the period 1st January to 23rd May 1935 totalled 436,992 tons, a decrease of 17.7 per cent. as compared with 1934. Of the 1935 shipments, 56.6 per cent. were from Burma, 1.8 per cent. from Japan, 33.7 per cent. from Saigon, 5.7 per cent. from Siam, and 2.2 per cent. from Bengal. The 1934 percentages were 43.6, 2.9, 38.8, 11.0 and 3.7 respectively.

Shipments to the Levant from the East for the period 1st January to 22nd April 1935 aggregated 19,428 tons, an increase of 15 per cent. over 1934.

Shipments to Cuba, West Indies and America for 1st January to 26th April, 1935, were 99,277 tons, an increase of 92.4 per cent. as compared with 1934.

MALAYAN AGRICULTURAL EXPORTS, MAY, 1935.

PRODUCT.	Net Export in Tons.				
	Year 1934.	Jan.-May 1934.	Jan.-May 1935.	May 1934.	May 1935.
Arecanuts ...	18,882	15,521	10,110	2,974	1,860
Coconuts, fresh † ...	100,826†	37,735†	39,093†	6,250†	7,169†
Coconut oil ...	25,485	10,750	12,504	2,419	2,705
Copra ...	95,618	38,352	42,814	5,023	3,734
Gambier, all kinds ...	2,170	913	1,139	220	208
Oil cakes ...	11,273	4,971	3,246	740	555
Palm kernels ...	3,196	1,142	1,381	280	310
Palm oil ...	15,852	4,950	8,677	1,038	1,585
Pineapples canned ...	66,633	29,514	29,284	8,854	8,795
Rubber ¶ ...	479,371¶	210,672¶	164,398¶	46,769¶	32,930
Sago,—flour ...	10,503	4,131	4,778	728	183
„ —pearl ...	6,177	1,775	1,837	468	351
„ —raw ...	7,079*	2,400*	2,766*	637*	639*
Tapioca,—flake ...	5,761	3,585	848	613	266
„ —flour ...	1,842*	898*	461*	227*	156*
„ —pearl ...	15,770	6,852	6,553	1,606	1,703
Tuba root ...	481	258½	256½	43	79½

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION IN TONS OF PALM OIL AND KERNELS

(As declared by Estates)

Period.	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January 1935 ...	1,062.3	339.3	174.0	49.6
February „ ...	977.4	220.9	161.7	38.5
March „ ...	1,104.3	334.2	172.6	48.6
April „ ...	1,008.2	328.0	151.2	40.4
May „ ...	1,077.1	461.8	158.6	63.1
Total ...	5,229.3	1,684.2	818.1	240.2
Total-January to May 1934	4,483.5	1,268.3	791.1	248.0
Total for year 1934 ...	12,965.0	4,510.0	2,013.0	795.0

MALAYA RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31ST MAY, 1935.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1933 (*d*)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (*a*)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5)	Percentage of (9) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
STRAITS SETTLEMENTS :—									
Province Wellesley	44,691	490	1.1	9,226	20.6	892	2.0	9,716	21.7
Malacca	123,793	460	.4	21,575	17.4	2,899	2.3	22,035	17.8
Penang Island	2,593	198	7.6	246	9.5	163	6.3	444	17.1
Singapore Island	33,312	4,107	12.3	6,301	18.9	510	1.5	10,408	31.2
Total S.S. ...	204,389	5,255	2.5	37,348	18.3	4,464	2.2	42,603	20.8
FEDERATED MALAY STATES :—									
Perak	295,895	5,628	1.9	45,372	15.3	13,965	4.7	51,000	17.2
Selangor	345,100	8,926	2.6	44,570	12.9	13,054	3.8	53,496	15.5
Negri Sembilan	258,381	10,246	3.9	35,845	13.9	14,405	5.6	46,091	17.8
Pahang	75,912	4,357	5.7	20,817	27.4	11,144	14.7	25,174	33.1
Total F.M.S. ...	975,288	29,157	3.0	146,604	15.0	52,568	5.4	175,761	18.0
UNFEDERATED MALAY STATES :—									
Johore	(*b*) 365,400	13,420	3.7	28,853	7.9	22,975	6.3	42,273	11.6
Kedah (*c*)	199,180	3,880	1.9	22,423	11.3	19,349	9.7	26,303	13.2
Kelantan	28,891	403	1.4	7,571	26.2	5,547	19.2	7,974	27.6
Trengganu (*e*)	4,643	Nil	Nil	20	.4	5	.1	20	.4
Perlis (*d*)	1,206	Nil	Nil	608	50.4	Nil	Nil	608	50.4
Brunei	(*e*) 4,991	Nil	Nil	1,457	29.2	878	17.6	1,457	29.2
Total U.M.S. ...	604,311	17,703	2.9	60,932	10.1	48,754	8.1	78,635	13.0
TOTAL MALAYA ...	1,783,988	52,115	2.9	244,884	13.7	105,786	5.9	296,999	16.6

Notes :—(*a*) Area out of tapping on Estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.
(*b*) Registered Companies only.
(*c*) Rendered quarterly.
(*d*) Figures are as reported by estate managers.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MAY, 1935 IN DRY TONS.

State or Territory 1	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		Jan. to May inclusive 1935		during the month		Jan. to May inclusive 1935						
	Ports	Dealer	Estates of 100 acres and over	during the month	January to May inclusive 1935	during the month	January to May inclusive 1935	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January to May inclusive 1935
MALAY STATES :—	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Federated Malay States ...	...	11,357	10,401	11,142	56,316	7,297	31,455	Nil	Nil	17	Nil	14,226	5,111	73,755	17,522		10,264	10,585	11	44
Johore ...	...	2,364	3,957	3,941	19,620	2,803	17,956	Nil	12	Nil	93	2,965	4,334	12,271	23,835	...	1,949	3,829	...	...
Kedah ...	...	338	2,094	2,475	12,540	926	4,821	Nil	Nil	Nil	Nil	1,346	1,955	7,430	9,167	...	265	2,267	...	...
Perlis ...	...	19	24	15	65	18	73	Nil	Nil	Nil	Nil	Nil	39	Nil	140	...	18	19	...	...
Kelantan ...	...	381	263	267	1,547	629	2,362	Nil	Nil	Nil	Nil	143	809	627	3,028	...	363	225	...	...
Trengganu ...	...	55	50	197	1,137	98	569	Nil	Nil	Nil	Nil	Nil	295	Nil	1,706	...	55	50	...	...
Brunei	...	13	36	50	238	59	290	...	...	...	...	...	114	...	510	...	12	32	...	...
Total Malay States	...	14,527	16,825	18,087	91,463	11,830	57,526	Nil	12	17	93	18,680	12,657	94,083	55,908	...	12,926	17,007	11	44
S. SETTLEMENTS :-																				
Malacca ...	...	2,896	1,475	1,175	6,630	767	3,292	Nil		Nil		2,714		14,593		...	2,777	1,300	...	...
Province Wellesley	...	1,364	507	516	2,449	197	1,045	Nil		Nil		7,722		35,695		...	1,899	400	...	...
Penang ...	...	11,313	15	20	80	68	391	2,594	11,834	11,693	57,164		Nil		Nil	3,988	10,154	11	...	...
Singapore ...	2,392	31,982	234	165	957	89	502	21,028		73,800		22,237		114,859		5,127	35,471	252	40	195
Labuan	3,140	53	Nil	Nil	Nil	16	63	98		494		Nil		Nil		...	33	Nil	...	...
Total Straits Settlements	5,532	47,608	2,231	1,876	10,116	1,137	5,293	23,720	11,834	85,987	57,164	32,673	Nil	165,147	Nil	9,115	50,334	1,963	40	195
TOTAL MALAYA	5,532	62,135	19,056	19,963	101,579	12,967	62,819	23,720	11,846	68,004	57,257	51,353	12,657	259,230	55,908	9,115	63,260	18,970	51	239

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	9,176	30,995	8,859	4,418	1,553	126
WET RUBBER	1,088	4,476	1,295	303	396	139
TOTAL ...	10,264	35,471	10,154	4,721	1,949	265

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January to May 1935 31
Singapore ...	33,354	174,287
Penang ...	11,527	56,387
Port Swettenham.	6,057	26,887
Malacca ...	415	1,669
MALAYA ...	51,353	259,230

TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January to May 1935 34
Malay States ...	31,399	140,969
Straits Settlements	3,207	14,202
MALAYA ...	34,606	155,171

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [9] = Columns [15] + [16] + [19] + [20] + [21] + [22] − [4] − [5] − [6] − [7] − [11] − [12]. For the Straits Settlements the production of of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Column (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22 June, 1935.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1935.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of		Mean of A and B.	Absolute Extremes				At 1 foot	At 4 feet	Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.		Highest Max.	Lowest Min.	Lowest Max.	Highest Min.						Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	90.5	72.6	81.5	95	71	85	75	84.8	85.3	6.71	170.4	2.47	17	14	3	1		199.00	6.42	52
Bukit Jeram, Selangor ...	88.2	73.1	80.7	90	71	84	75	83.9	86.1	7.82	198.6	1.40	18	16			1	210.80	6.80	55
Sitiawan, Perak ...	89.9	73.3	81.6	92	71	87	75	84.5	85.5	4.66	118.4	1.66	14	13	1			199.80	6.45	52
Temerloh, Pahang ...	90.9	72.9	81.9	95	70	87	75	86.4	86.7	2.47	62.7	0.69	10	8	5	5		213.85	6.90	56
Kuala Lipis, Pahang ...	89.6	72.4	81.0	92	71	86	74	84.3	84.8	5.22	132.6	1.00	17	14	3	24		194.40	6.27	51
Kuala Pahang, Pahang ...	87.7	74.9	81.3	92	70	85	77	85.5	85.9	10.93	277.6	2.84	14	13	2			270.45	8.72	71
Kallang Aerodrome, S'pore ...	85.9	75.7	80.8	90	71	80	80	81.7	83.3	6.84	173.7	1.36	17	14	3		1	183.40	5.92	49
Butterworth, Province Wellesley ...	87.9	75.0	81.5	91	73	84	77	85.6	86.0	4.05	102.9	0.83	14	12			1	196.40	6.34	51
Bayan Lepas Aerodrome, Penang ...	87.2	74.8	81.0	90	73	82	78	85.1	86.3	12.55	318.8	2.36	21	17	4		1	192.80	6.22	51
Bukit China, Malacca ...	84.7	73.3	79.0	87	70	81	76	83.8	84.9	8.90	226.1	1.53	19	18	4		4	202.55	6.53	54
Kluang, Johore ...	87.7	70.9	79.3	93	69	78	73	82.1	82.8	10.55	268.0	2.24	18	18	4	10	1	181.40	5.85	48
Bukit Lalang, Mersing, Johore	87.3	72.5	79.9	91	71	82	75	83.1	82.7	4.04	102.6	1.00	17	15	7	4	1	218.75	7.06	58
Alor Star, Kedah ...	87.9	75.3	81.6	92	73	83	78	86.6	86.1	10.59	269.0	2.03	22	16	5			207.05	6.68	54
Kota Bahru, Kelantan ...	90.6	74.6	82.6	92	72	87	77	85.3	85.1	9.86	250.4	3.73	17	14	1			241.30	7.78	63
Kuala Trengganu, Trengganu	89.9	73.8	81.9	92	71	86	76	84.3	84.9	4.76	120.9	2.47	14	10	1	1	2	235.80	7.61	62
HILL STATION.																				
Fraser's Hill, Pahang 4268 ft.	75.1	63.2	69.1	79	61	70	65	72.1	72.6	2.49	63.3	0.86	20	14	2	12		171.40	5.53	45
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.3	57.6	65.5	76	51	69	62	70.8	70.1	8.81	223.8	1.14	25	20			1	132.90	4.29	35
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.4	59.9	66.1	76	58	67	62			9.50	241.3	1.28	24	22			1	144.25	4.65	38

Compiled from Returns supplied by the Meteorological Branch, Malaya